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COMMUNICATION SYSTEMS FOR EMERGENCY OPERATIONS

Captain Kenneth Price, SCSG

The recent hurricanes, and in particular, Hurricane Katrina, have demonstrated a basic weakness in many communications systems depended upon by public service organizations. Most systems were primarily designed for "normal" conditions, meaning that it was assumed that electrical power would be available, that radio towers would be operational, and that the volume of radio traffic would be within the design limits. Unfortunately, like a chain, such systems fail completely when any one of the needed links ceases to function as intended. When such systems fail, "Command & Control" become difficult, if not impossible.

In the South Carolina State Guard we have a Division Communications Section, and each Brigade has a Communications Section. Division operates a communications "bus," with 800 MHz radios and other equipment primarily designed for interface with statewide Public Service communications. At First Brigade we decided to concentrate our efforts on a more localized theater of operations, including Battalion and Company level, but expandable when required to cover state-wide, and even world-wide communications. This has been done by our choice of equipment, and by demonstrating to different authorities that we have the capability in both training and equipment to fulfill the missions we have undertaken.

The key to reliable communications is the ability to anticipate "worst case" situations. We have to assume that "Murphy" is always part of any operation, and that "if anything can go wrong, it will go wrong."

Modern radio communications systems, including cellular telephones, depend on a complex system of multiple radio towers with computer control over the total system. A breakdown in any part of the systems risks the loss of the total system. These systems are also extremely expensive, with each portable radio in the range of $1,000.00 and the central control station costing as much as 100 times as much.

The 1st Brigade, South Carolina State Guard, has begun planning for communications needs after an event that could involve the loss of any or all of the systems currently used by Public Safety in the state. We are planning for a "disaster" at least as severe as Hurricane Katrina, involving the loss of commercial electrical power, the loss of most, if not all, functioning radio systems, and impassable roads making deployment of heavy equipment difficult or impossible.

Based on these assumptions we began by looking at what communications would be needed, what equipment was economically available, and what would be expected from such equipment, and operators. With no commercial power available, all radios would have to be battery operated, and use both rechargeable and disposable batteries, preferably "AA" or similar, easily and cheaply available on the local market. These radios would also have to be easy to operate, and the operators not required to have licenses requiring a demonstrated technical ability. We selected radios operating in the GMRS (General Mobile Radio Service) 450 MHz band, for which the Federal Communications Commission

will issue a five-year license covering six radios, for a payment of $75.[1] These radios provide reliable communications up to five miles, depending on terrain and obstructions.

GMRS radios normally operate "point to point," so there are no problems with the loss of infrastructure. However it soon became apparent that there were cases where longer range would be required, and we began looking into finding a "repeater" that could be man portable, inexpensive and easy to install and maintain. We were able to find a small, self-contained repeater that weighed less than five pounds, would operate on 12 volts and would operate for several days on a small motorcycle battery. Depending on the height we place the repeater and antenna, we can extend the range of the hand-held radios out to as much as 30 miles.

While the GMRS radios and repeater system solved the short and medium range communications problem it soon became obvious that we might require longer range communications. To solve this problem we adopted a double strategy; the first was to contact amateur radio clubs in the state and ask for their assistance, either as "associates" of the South Carolina State Guard (SCSG) or, in a few cases, by recruitment of individuals into the SCSG. We also found several current Guard members who hold amateur radio operators licenses, and using these individuals we were able to establish a South Carolina State Guard Amateur Radio club and apply to the Federal Communications Commission for a "Club License." We were granted the license with the call sign K4SCG and now use that call for our operations.[2]

While GMRS radios are readily available at such stores as Radio Shack and K-Mart, we felt that such equipment would not stand up to the use to which we intended to subject it. We also felt that the inexpensive equipment lacked the reliability our possible missions would require. We decided on radios manufactured by ICOM, as these radios are "Mil-Spec," yet relatively inexpensive, at $150 each, and one of the few radios able to work with a repeater. We also had the assistance of a supplier in San Antonio, Texas (K-Com, Inc.) in developing the specifications for both the radios and the repeater, as well as supplying and modifying the amateur radios equipment we are using. This equipment will now operate on all amateur frequencies, as well as Military Affiliate Radio Service (MARS) frequencies. We currently have 20 of the ICOM radios, and plan to purchase at least 10 additional units. Our amateur radio equipment consists of two Kenwood VHF/UHF radios with digital capabilities, and one Yaesu 897 radio that can operate on HF, VHF and UHF frequencies. All equipment can be powered by 12-volt batteries. In addition, members of the Communications Section have personally owned equipment that they bring to deployments, effectively doubling the amount of amateur radio equipment available to the SCSG.[3]

While this program is still very much a "work in progress," it has been used successfully during several deployments, including training operations with the State Office of Emergency Management.

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[1] A full explanation of repeaters and how they operate can be found at http://www.arrl.org/FandES/field/regulations/faq-aux.html , which also includes the applicable Federal Communications Commission regulations and licenses required. Some knowledge of the subject matter is required to to properly search the article.

[2] The "bible" on all aspects of the operation and use of amateur radios, including how the amateur radio functions and all the information needed for licensing can be found at http://wireless.fcc.gov/services/index.htm?job=licensing&id=amateur .

[3] Information and forms for owning and operating personal amateur radio equipment can be found at http://www.fcc.gov/Forms/Form605/605.html .

We also received considerable financial support from the City of Columbia, South Carolina, which enabled us to purchase a 17 foot, air conditioned trailer with an 8-Kw gasoline generator. This is being converted into a mobile Command Post and when completed will have a 60 foot telescoping radio tower on which we will mount our GMRS repeater as well as some of the amateur radio antennas. All equipment in the trailer can operate on internal battery power, and can be taken out of the trailer and hand carried into an Operational Area should we be unable to get the trailer to the scene of operations. The trailer also will be equipped with several large gel-cel, 12-volt rechargeable batteries so as to provide power during periods when the generator cannot operate. All equipment in the trailer is designed to operate on 12-volt power, other than the air conditioning system.

As an example of our capabilities, the 1st Brigade was recently called upon to support a training exercise with two county Offices of Emergency Management. We provided over 60 troops to sites in Aiken and Barnwell counties, in Tactical Operations Centers (TOCs) located about 30 miles apart. Using 20 of our GMRS radios we coordinated troop movements at each location, and utilizing an amateur radio 2-meter repeater located in Augusta, Georgia we linked the two TOCs and allowed the Commanding General to exercise overall Command and Control of the operation. The Emergency Operations Center (EOC) Supervisor was extremely complementary about our efforts, and in particular, our ability to maintain communications with our troops, and between the two operational offices.

Future planning in 1st Brigade Communications include the development of satellite communications utilizing amateur radio satellites already in orbit, development of Global Positioning System (GPS) satellites to locate the position of different SCSG teams in the field, and the linking of Communications Section laptop computers via amateur radio to convert GPS information to allow State Guard commanders to have a overall operational "picture" of the current situation.

While still very much a "work in progress," we feel that we are developing a solid foundation upon which to build our communications system, both for normal operations, and a system that will work reliably in the event of an emergency.[4]

[4] The author invites inquiries on the structure and use of this emergency communication system to his E-mail address "CPT Kenneth Price, SCSG" <kenprice@att.biz> .